Faculty Working Papers

THE MARKET MODEL: POTENTIAL FOR ERROR

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TOWARDS A RECONCILIATION OF THE COMPARABLE EARNINGS, DCF, AND CAPM APPROACHES TO PUBLIC UTILITY RATE REGULATION: AN EMPIRICAL ANALYSIS

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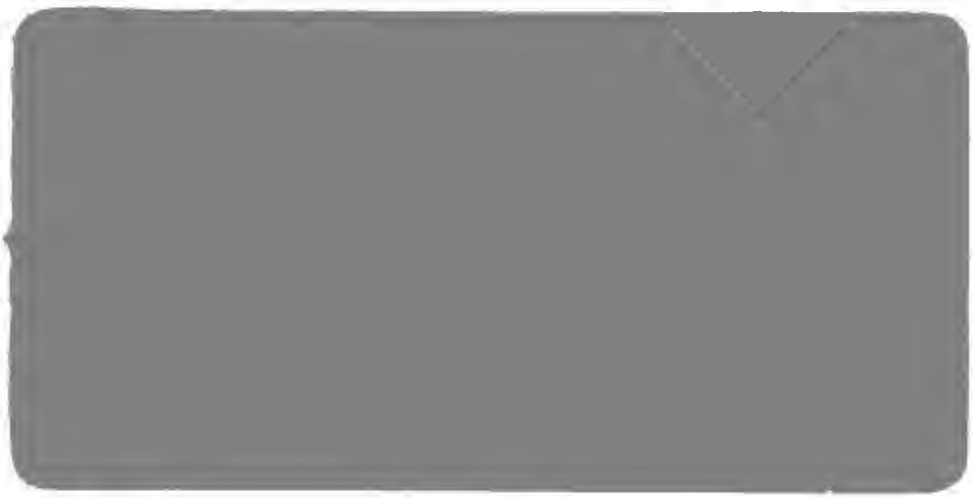

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TOWARDS A RECONCILIATION OF THE COMPARABLE EARNINGS, DCF, AND CAPM APPROACHES TO PUBLIC UTILITY RATE REGULATION: AN EMPIRICAL ANALYSIS

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Summary:

Regulatory rate hearings reveal the three common approaches to estimating equity capital costs, the comparable earnings method, the discounted cash flow model, and the capital asset pricing model, coexist more as rival rather than complementary techniques. This paper attempts to reconcile these three approaches to public utility rate regulation.

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INTRODUCTION

Regulatory approved utility service prices are set to allow recovery of costs, including interest, taxes and depreciation, plus a "just and reasonable" rate of return on common equity investment. Legal precedents define this "just and reasonable" return as a rate commensurate with the rates available on alternative investments having comparable risks, and sufficient to enable the utility to attract capital and to maintain its financial integrity. Implementation of these legal standards has become perhaps the most controversial issue in regulatory proceedings. The problem is that the ambiguous law relating to rate of return determination causes controversies over the appropriate estimating procedure.

This paper attempts to reconcile the rate of return estimates of the three most widely used rate of return estimating procedures in regulatory hearings, the comparable earnings (CE) method, the discounted cash flow (DCF) model, and the capital asset pricing model (CAPM). The paper begins with a brief review of the notion of a just and reasonable return and the application of the three conventional rate of return estimating procedures. The data and methods used to develop required return estimates for the CE, DCF, and CAPM models are developed in the next section. An accounting beta logic is used to select non-regulated firms with earnings comparable to utilities in an attempt to overcome the subjectivity traditionally associated with the CE method. Empirical testing of the comparability of the required return estimates generated by the three estimating procedures comprises the penultimate section. Concluding comments appear in the last section.

THE NOTION OF A JUST AND REASONABLE RETURN

There is little debate in practical circles about the broad purpose of regulating public utilities' rates of return. Regulation by a public body is to substitute for the competitive market mechanism in determining the prices and services offered by profit orientated monopolies.

Utility regulation attempts to achieve the allocative efficiency that would exist if utilities operated in a competitive market by fostering the same marginal conditions that exist under a competitive environment [8, 18]. Commissions regulate electric utilities by approving service prices that are expected to generate revenues sufficient to allow recovery of costs, including interest, taxes, and depreciation, plus a fair return on equity investment. The governing lgoic of what constitutes an appropriate rate of return for regulators to approve is the Supreme Court's statement in the Hope decision:

> The return to the equity owner should be commensurate with returns on investment in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise so as to maintain its credit and to attract capital.[1]

The first sentence establishes a "comparable earnings" standard, the second, a "capital attraction" standard. But the language of the Hope decision is sufficiently broad that alternative interpretations of these standards exist.

Theory suggests that the "comparable earnings" standard for rate of return regulation should be utilities' cost of capital [18]. A firm's expected return on incremental investment in competitive equilibrium theory is the firm's cost of capital. Should regulators allow utilities to charge service prices that create expected returns on new investment

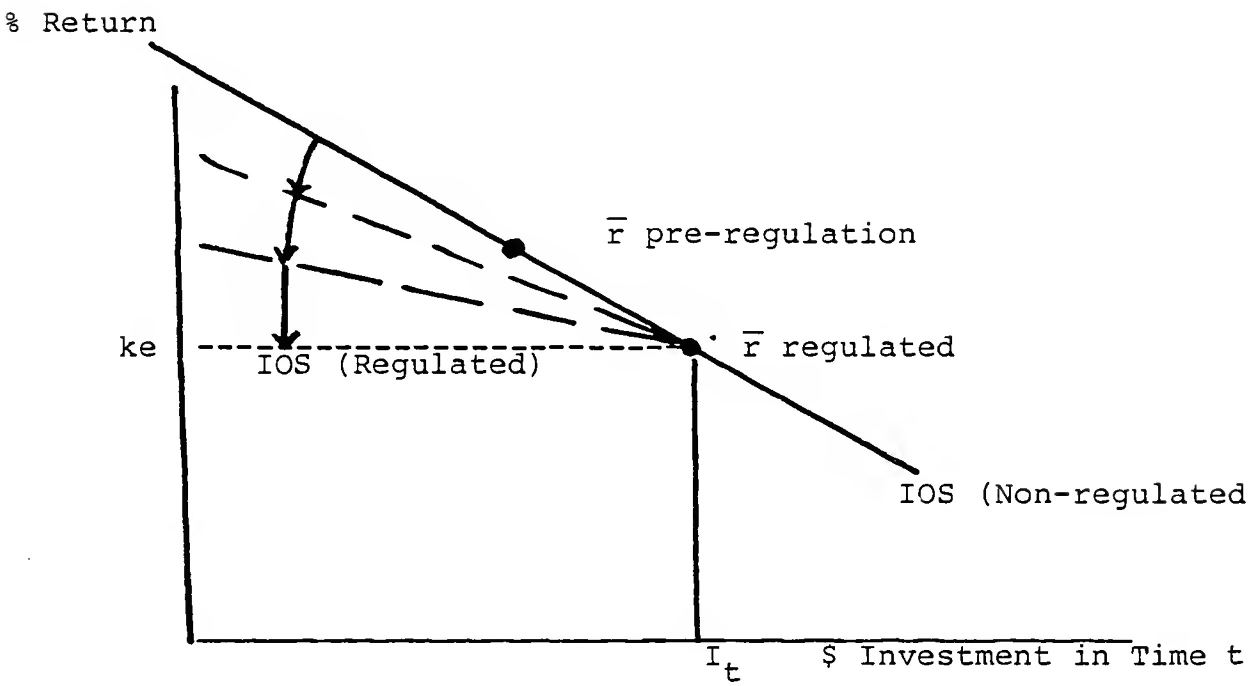
equal to investors required return, then the Hope decision's comparable earnings and capital attraction standards would appear to be met.

In a competitive industry the market value of a firm is the capitalized earning value of its assets, or, stated alternatively, the cost of constructing and operating comparable capacity at current factor prices. Investment capital will flow into the industry as long as demand is sufficient to permit the marginal firm to earn a return equal to the cost of capital. The marginal firm's book and market values tend to be equal since the firm is constructed and operated at current factor prices and earns a return just equal to the cost of capital. The intramarginal firm may have positive net present value investment opportunities or projects with returns on the equity investment portion (r) greater than equity investors required return, ke. Such excess returns are economic rents which become capitalized in the market value of equity, and cause capitalized or market value to exceed book value. Of course, the existence of economic rents does not effect the necessary marginal condition (r = ke) for new capital to enter the industry.

Cost of capital orientated regulation can function to preserve for the public, instead of the producer, the benefits of a natural monopoly [8]. Figure 1 depicts how regulation directed toward allowing an average rate of return on investment equal to a utility's cost of capital could tend to eliminate economic rents, or investment returns greater than the cost of capital, without depriving investors of a competitive return. In terms of Figure 1, the unregulated firm will accept all investment projects offering an internal rate of return on the equity financed portion, r, greater than or equal to the cost of equity capital,

FIGURE 1

THE IMPACT OF REGULATION UPON A FIRM'S
INVESTMENT OPPORTUNITY SCHEDULE (IOS)
FOR THE EQUITY FINANCED PORTION OF PROJECTS



ke. The average return on accepted projects, $\bar{r}$, exceeds ke but the opportunity cost for employment of equity capital remains ke.[2]

Utility regulation can tend to eliminate returns greater than ke by approving service prices that are expected to generate revenues only sufficient to allow recovery of costs, including interest, taxes, and depreciation, plus just a ke return on the equity financed portion of the asset investment. As shown in Figure 1, this approach to regulation can eliminate r > ke investments while leaving unchanged the marginal conditions that determine the quantity of investment capital entering the industry. Stated differently, under regulation $\bar{r}$ = r = ke, while $\bar{r}$ > ke for the non-regulated firm in an industry with an upward sloping supply curve.

Methods of Estimating the Cost of Equity Capital

At the present time there are three approaches to estimating the cost of equity capital that frequently appear in rate of return hearings; the comparable earnings (CE) method, the discounted cash flow (DCF) model, and the capital asset pricing model (CAPM). Both the DCF and CAPM are stock market equilibrium models and provide market estimates of investors' expectations regarding the marginal return on new investment in an industry. The CE approach is the most widely used method,[3] but it is based upon observed average book rates of return on past investments of firms judged to have comparable risk.

The DCF method suggests the cost of equity capital, ke, can be expressed as

$$ke = D_1/P_o + g \tag{1}$$

where D_1 is the dividends per share in the next period, P_o is the current price per share of stock, and g is the expected growth rate in dividends per share. ke measures the rate of return investors anticipate when they purchase shares in firms with specific expected earnings and risk characteristics. It is a market rate of return defined in terms of anticipated dividends and capital gains relative to stock prices.

The other stock market equilibrium model is the CAPM which expresses the expected holding period rate of return on equity for company j $(\tilde{R}j)$ as

$$E(\tilde{R}j) = R_f + \beta_j \, E(\tilde{R}m - R_f) \tag{2}$$

where R_f is the risk free rate, $E(\tilde{R}m-R_f)$ is the expected holding period risk premium on the market, β_j is the measure of systematic risk for company j, and the tildes denote random variables. The CAPM posits an asset's excess return is directly proportional to its β or systematic risk. Moreover, it is clear that an asset's return will contain no premium for unsystematic risk since portfolio diversification can eliminate unsystematic risk.

$E(\tilde{R}_j)$ is a risk adjusted estimate of investors required or expected return. Assuming the stock market is in equilibrium, then $E(\tilde{R}_j)$ should equal ke_j, since both models attempt to measure the required return expectations of equity investors. $E(\tilde{R}_j)$ and ke_j are also estimates of the marginal return on new investment in a competitive unregulated industry. Stockholders in a regulated public utility can hold their shares, or sell their shares and either purchase shares or undertake direct investment in unregulated industries of equal or comparable risks. In market

equilibrium, the yield on investments of comparable risk will be equal. Accordingly, required return on public utility stocks as measured by $E(\tilde{R}_j)$ and ke_j is an estimate of the required equilibrium return on shares of comparable risk, unregulated firms in a competitive industry, as well as an estimate of the returns available on new investment in unregulated firms of corresponding risks. Thus, a $E(\tilde{R}_j)$ or ke_j estimated required return provides not only the same marginal conditions that exist under conditions of competition, but also provides a yield that would appear to meet the Hope decision's comparable earnings and capital attraction standards [8].

The CE method of estimating a just and reasonable return generally consists of examining the profitability of a sample of other public utilities and/or unregulated firms purported to be comparable in risk to the firm under regulatory review. The mean accounting return on common equity capital for the set of comparable firms, R_{cec}, is taken under this approach to be a measure of the cost of equity capital. To advance R_{cec} as a measure of required return is to argue that a utility should be allowed to earn in the future what it would have earned on the average in the past had its capital been invested in other firms of comparable risk [18, p. 62].

The CE method does not compare favorably with the DCF and CAPM approaches to estimating equity capital cost. First, the DCF and CAPM methods handle risk automatically while risk must be treated explicitly when using the CE approach. It is difficult in practice to identify a suitable set of firms with corresponding risks. Transcripts of rate regulatory hearings reveal risk assessment and the selection of comparable

risk firms is highly subjective. Further, CE proponents have not progressed in the direction of evolving a theory about the relationship of risk and book rates of return.

Second, there is the question of whether accounting rates of return accurately proxy the economic return to capital. Solomon [23], Stauffer [24], and others have shown that "two companies with similar DCF rates may well show widely differing book rates of return" [23, p. 78]. The size and direction of the discrepancy between accounting and economic rates of return can be an extremely complicated function of the economic life of investment projects, the rate of growth of the capital budget, depreciation and capitalization poilicies, the time configuration of cash flows, and other factors.

A final drawback to the CE approach is that it is backward looking while equity investors required return is based upon anticipated dividends and capital gains relative to stock price. Required return is an opportunity cost reflecting the risk adjusted rate of return on an incremental investment in the best alternative. The return on book equity is not forward looking. Neither is it incremental which means an average rather than marginal return on investment will be used to estimate a just and reasonable return. As long as the industry supply curve is upward sloping, the average return on investment in the industry will exceed the marginal return on investment. Thus the CE method does not foster the same marginal conditions that exist under conditions of competition. A necessary condition for allocative efficiency is that the marginal return on new investment equal the marginal cost of capital. If utility firms are permitted to earn the CE estimate on all investment,

then utility firms would be encouraged to undertake excessive investment and would earn a higher return on new investment than is earned on incremental investment by comparable firms in unregulated industries [8, p. 356].

Regulatory proceedings reveal the CE, DCF, and CAPM models coexist more as rival rather than complementary approaches to estimating equity capital cost. An assumption of stock market equilibrium implies the DCF and CAPM models should provide comparable estimates of equity capital cost. Because the CE method generates a measure of the average rather than the marginal returns on investment, R_{cec} would be expected to exceed DCF and CAPM estimates. That is, R_{cec} will provide an estimate for the pre-regulation $\bar{r}$ in Figure 1 while $E(R_j)$ and ke provide estimates for the marginal cost of equity capital. However, when the averaging of past data are used to estimate R_{cec} changes in the market and/or changes in growth opportunities may cause $E(R_j)$ and ke to be greater than the average R_{cec}. The observable association between R_{cec}, $E(r_j)$ and ke will depend importantly upon whether book rates on past investments somehow proxy investor's expected returns, upon how accurately accounting rates reflect economic rates on book equity, upon the slope of utility IOS curves, and upon the set of firms determined to have corresponding risks. Whether R_{cec} can provide a useful, corroborative estimate of equity capital costs is a question to be answered empirically.

CE-DCF-CAPM REQUIRED RETURN ESTIMATION: DATA AND METHODS

Equity capital cost measures for single firms are subject to measurement errors and biases. A partial solution to this measurement difficulty for purposes of rate regulation is to broaden the sample to a set of "equivalent risk firms" and estimate a plausible "zone of confidence" for the equity cost of

the average firm in the set. But this requires an operational definition of "equivalent risk."

While there is no consensus as to how to identify "sets of equivalent-risk firms," Beaver, Kettler, and Scholes [2], Beaver and Manegold [3], Gonedes [12], and Ball and Brown [1], have found systematic associations between various accounting measures and the β market measure of risk. Bowman [5] has developed a theoretical linkage between accounting betas and the market beta measure of risk. These studies suggest that accounting betas can provide objective measures for assessing the risk comparability between (utilities and nonregulated) firms. This study utilizes several alternative accounting beta measures to identify sets of equivalent risk nonregulated firms (based on accounting earnings) needed to assess the comparability of the CE, DCF, and CAPM equity cost estimates for utilities.

Estimates of R_{cec}, $E(R_j)$, and ke are developed for year end 1976 for the 30 of the 35 S&P utility index firms for which Compustat data were available for the 1957-1976 period. While it is likely that utilities have comparable risks, basing the return allowed upon the returns experienced by utilities in the past does not satisfy the Hope decision's criteria of "commensurate returns on investments in other enterprises of corresponding risks." Limiting the reference set of comparable firms to those in the same regulated industry can cause regulation to become a circular process. This circularity issue is most apparent with the CE approach. But it is also relevant for the two market models which use historical data to proxy expectations. Historical industry return data may embody eposodic and/or regulatory induced adjustments that can bias the $E(R_j)$ and ke estimates [6, 11]. For this reason a sample of non-regulated firms of corresponding risk is needed to meet the Hope decision's comparable earnings and capital attraction standards.

Seven sets of non-regulated firms with characteristics comparable to the S&P index utilities are constructed. Each set is of size 60 and is selected from the 208 firms of the S&P 425 which have Compustat data available for the 1957-1976 period and which have a December fiscal year. The sets are formed and the variables are calculated as of year end 1976. Four of the seven sets are formed using accounting betas based upon: (1) earnings per share; (2) change in earnings per share; (3) the earnings per share$_t$/price per share$_{t-1}$; and (4) book return$_t$/common equity capital$_{t-1}$. Accounting beta measures are calculated using 20 years of annual data. The market index for each measure is the 208 firm average.

Two other sets of non-regulated firms are formed using market beta measures: one is based on the holding period returns of the 208 firms and the other based on the Fisher Index. The final set was constructed using a measure designed to identify capital intensive firms [$\sum_{t=1}^{5}$ Depreciation$_t$/ $\sum_{t=1}^{5}$ Earnings Before Interest and Taxes]. The market beta or holding period return set of firms was included because it includes non-regulated firms that provided comparable returns after the fact. It may be that "the fairness of the rate of return to equity holders [of utilities] can only be judged retrospectively [22, p. 702]." The last set of firms was selected to see if capital intensive firms display similar equity capital cost measures.

The 60 firm sets of comparable firms were formed by ranking the 208 industrial firms on each measure, and then selecting the 30 firms on either side of the mean value of the 30 utility firms. Estimates of R_{cec}, $E(R_j)$, and ke are then developed for the seven 60 firm sets.

Estimates of ke for the utility set and the 7 sets of non-regulated firms were derived following the Federal Power Commission's Office of Economics DCF model

$$ke_{jt} = \frac{DPSS_{jt}}{P_{jt}} + SGEPS_{jt} \tag{3}$$

where $DPSS_{jt}$ = exponentially smoothed (5 years) dividends per share for firm j in year t;

P_{jt} = price per share for firm j at end of year t; and

$SGEPS_{jt}$ = exponentially smoothed (5 years) growth rate of earnings per share for firm j in year t.

The details of the exponential smoothing procedure are presented in [9] and [10].

CAPM equity cost estimates are calculated following equation (4)

$$E(R_{jt}) = R_{F_t} + \beta_{jt}\,(R_{M_t} - R_{F_t}) \tag{4}$$

where R_{F_t} = market yield on one year U.S. Treasury Bills as of December of year t;

$R_{M_t} - R_{F_t}$ = risk premia on the market portfolio; and

β_{jt} = cov (R_{jt}, R_{M_t})/var (R_{M_t})

where R_{jt} and R_{M_t} are five years of monthly holding period returns (ending in December of year t) for security j and the Fisher Index.

Ibbotson and Sinquefield's [14] risk premia data show the risk premium on common stock averaged 8.17 percent in the 1926-1966 period, 6.68 percent in the 1926-1976 period, and 9.90 percent in the 1952-1966 period. An annualized monthly risk premia of 10 percent is used to calculate $E(R_{jt})$ in 1966 and 1976.

R_{cec} is calculated by relating the earnings available to common equity capital in year t to equity book value in year (t-1). Annual holding period returns (HPR) were also calculated.

The data required for calculating R_{cec}, ke, and $E(R_j)$ were obtained for the 1957-1976 period from the Compustat and CRSP tapes, and the Federal Reserve Bulletin.

COMPARABILITY OF THE R_{cec}, ke, and $E(R_j)$ MEASURES

A two stage analysis was utilized to examine the comparability of the R_{cec}, ke, and $E(R_j)$ measures of required return on equity. The first stage examines the relationships which exist (if any) among the three cost of equity measures for the seven groups of non-regulated firms with comparable earnings betas. The second stage of the analysis compares the cost of equity capital measures of the thirty S&P index utilities with those of the seven sets of comparable industrial firms as suggested by Myers [18].

The methods used in forming the seven sets of comparable firms, four accounting beta sets, two market risk sets, and a set of firms of comparable capital intensiveness, were discussed earlier. After the groups were formed, the three equity cost measures, the actual holding period return (HPR), and the market betas for the 60 industrial firm portfolios were calculated.[4] The results for the 1957-1976 period are presented in Table 1.

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Table 1 about here
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Several observations can be made. First, the estimates of $E(R_j)$ and R_{cec} are more stable than the estimate for ke across the alternative

TABLE 1

EQUITY CAPITAL COST ESTIMATES AND HOLDING PERIOD RETURN FOR THE 30 UTILITIES AND ALTERNATIVE SETS OF 60 INDUSTRIALS: 1957-1966

Sample Firms	Equity Capital Cost $E(R_j)$	Equity Capital Cost ke	Equity Capital Cost R_{cec}	Holding Period Return	Market Beta
30 Electric Utilities	.126 (.018)	.132 (.039)	.085 (.011)	-.004 (.023)	.796 (.177)
Sets of 60 Industrials					
β_{EPS_t}	.161 (.031)	.162 (.245)	.155 (.069)	.025 (.089)	1.144 (.313)
β_{EPS_t/P_t}	.154 (.033)	.229 (.237)	.161 (.063)	.058 (.105)	1.077 (.332)
$\beta_{\Delta EPS_t/EPS_{t-1}}$	.154 (.030)	.104 (.469)	.129 (.050)	.083 (.114)	1.077 (.301)
$\beta_{HPR:208}$	.150 (.021)	.227 (.260)	.163 (.066)	.084 (.096)	1.033 (.207)
$\beta_{R_{cec_t}}$	.146 (.029)	.155 (.795)	.148 (.065)	.075 (.095)	1.064 (.100)
$Depr/EBIT_t$	.160 (.030)	.241 (.445)	.146 (.051)	.049 (.097)	1.131 (.305)
β_{Market}	.125 (.093)	.209 (.277)	.147 (.062)	.089 (.095)	.788 (.093)

sets of industrials. $E(R_j)$ varies from 12.5% to 16.1% while R_{cec} varies from 12.9% to 16.3%. However, high (low) estimates using the $E(R_j)$ model did not occur with the same sets of industrials as the high (low) estimates of R_{cec}. Also, the standard deviation of the $E(R_j)$ estimate was consistently less than for the R_{cec} estimate (except when the groups were formed using a market beta). Second, the ke measure varied greatly from set-to-set; going from a low of 10.4% when the change in EPS was used for grouping, to a high of 22.9% when the E/P ratio was used. Furthermore, the standard deviation of the ke estimate was much greater than for either of the other measures. This variation was caused by the highly variable growth factor for industrial firms in the ke calculation. Finally, the market betas for all of the groups based on comparable earnings considerations were greater than 1.0, indicating systematic risk was similar to or greater than the market.

The correlations among the cost of equity measures, among the accounting beta measures, and between the cost of equity measures and the accounting beta measures for the 208 industrials are presented in Table 2. As can be seen, there were no significant associations among the cost of equity measures, $E(R_j)$, R_{cec}, and ke. This finding indicates that even when a group of unregulated firms with corresponding risk characteristics is selected, the three measures of the cost of equity capital may not be similar. An examination of the utility results revealed similar results.

Table 2 about here

There were, however, significant associations among the accounting beta measures and between the accounting betas and the equity cost measures.

TABLE 2

PRODUCT MOMENT CORRELATIONS AMONG ACCOUNTING BETAS AND RATE OF RETURN MEASURES FOR THE 208 INDUSTRIALS

Variable	β_{EPS_t}	$\beta_{\frac{EPS_t}{P_{t-1}}}$	$\beta_{\frac{\Delta EPS_t}{EPT_{t-1}}}$	$\beta_{HPR:208}$	β_{ROE_t}	$\frac{Depr_t}{EBIT_t}$	$E(R_j)$	HPR_t	R_{cec_t}	ke
β_{EPS_t}	1.000									
$\beta_{EPS_t/P_{t-1}}$	.216**	1.000								
$\beta_{\Delta EPS_t/EPS_{t-1}}$	-.055	.054	1.000							
$\beta_{HPR:208}$	-.214**	.238**	.208**	1.000						
β_{ROE_t}	-.028	.048	.192**	.136	1.000					
$Depr_t/EBIT_t$	.220**	.234**	-.008	.069	-.030	1.000				
$E(R_j)$	-.241**	.079	.212**	.608	.069	-.001	1.000			
HPR_t	.198**	-.143*	.038	.156*	.150*	-.437**	.125	1.000		
R_{cec_t}	.029	-.266**	.020	-.060	.198**	-.541**	.113	.526**	1.000	
ke	.196**	.207**	.044	-.023	.007	-.177*	-.111	.203**	.121	1.000

*Denotes significance at the .05 level.
**Denotes significance at the .01 level.

For example, the EPS accounting beta exhibited significant negative relationships with the HPR:208 beta and with the $E(R_j)$ cost of equity estimate. It exhibited significant positive relationships with the E/P beta, the capital intensive Depr/EBIT ratio, and the ke cost of equity estimate.

Besides examining the alternative equity cost estimates, HPR and market beta for each of the seven sets of 60 industrials, the make-up of the seven groups was also examined. That is, of the 60 firms which were included in the EPS beta group, how many of these were also included in the E/P ratio beta group, the ΔEPS/EPS beta group, etc. Because of the differing relationship among the accounting betas, it is expected that the sets of 60 industrials will show a good deal of variation in the firms selected for each set. Table 3 provides this information. The number of firms included in any two groups ranges from a high of 23 firms (38.3%) included in the HPR:208 beta and R_{cec} beta groups to a low of 11 firms (18.3%) for the ΔEPS/EPS beta and Depr/EBIT beta groups and for the EPS beta and market beta groups. The average group overlap was 17 firms.. Stated differently, for any two-group comparison, forty-three of the firms in any 60 firm set was not included in the other set. This relatively low amount of group overlap is one source of the variation in the equity cost estimates.

Table 3 about here

Summarizing, the first stage of the empirical analysis revealed: (1) the $E(R_j)$ and R_{cec} are much more consistent than the ke estimates across the seven groups of 60 firms; (2) the market betas (for the 60 firm groups based on accounting betas) are all greater than 1.0;

TABLE 3

COMMON GROUP MEMBERSHIP IN THE SEVEN SETS OF 60 INDUSTRIAL FIRMS

	β_{EPS_t}	$\beta_{EPS_t/P_{t-1}}$	$\beta_{\frac{\Delta EPS_t}{EPS_{t-1}}}$	$\beta_{HPR:208}$	$\beta_{R_{cec_t}}$	$\beta_{\frac{Depr_t}{EBIT_t}}$	β_{mkt}
β_{EPS_t}	60						
$\beta_{EPS_t/P_{t-1}}$	15	60					
$\beta_{\Delta EPS_t/EPS_{t-1}}$	14	12	60				
$\beta_{HPR:208}$	17	21	18	60			
$\beta_{R_{cec_t}}$	18	22	20	23	60		
$\beta_{Depr_t/EBIT_t}$	17	20	11	15	22	60	
β_{mkt}	11	19	15	18	16	14	60

(3) there is no significant correlation among the equity cost estimates; (4) several of the accounting betas were significantly correlated with the equity cost measures; and (5) the 60 firms in the alternative groups varied greatly from group-to-group.

The second stage of the study involved a comparison of the equity cost measures, the HPR and the market beta for the 30 utilities with the same measures for the alternative groups formed on accounting betas. These results are shown at the top of Table 1. As can be seen, the $E(R_j)$ for the 30 utilities is from 2% to 3.5% lower than for any of the industrial groups. On the one hand this difference is not surprising. The discrepancy can be explained by the difference between the average market beta for the 30 utilities of .796 versus 1.0+ average beta for the industrial firm sets. On the other hand, this difference is surprising since the industrial firm sets were constructed using accounting beta risk measures to insure only firms with risks comparable to utilities would be selected.

The cost of equity estimate for the 30 utilities using the ke measure was 13.2% with a standard deviation of 3.9%. The mean for the utilities is substantially lower than the mean ke for all but one of the sets of industrial firms. Also the standard deviation of the utilities ke measure is less than 1/6 the standard deviation of any of the industrial groups. Even though the utilities have accounting betas similar to the groups of industrials, the ke distribution for the utilities is much less dispersed than the industrial groups.

The five year geometric return on book equity for the utilities was less than any of the alternative industrial groups. The R_{cec} for

the 30 utilities averaged 8.5% while the R_{cec}'s for the industrials ranged from a low of 12.9% to a high of 16.3%.

As noted earlier, the market beta for the 60 firm sets are substantially higher than the market beta for the 30 utilities. Thus, even when the accounting earnings were comparable, by whatever measure, the market betas indicated the utilities exhibited substantially less systematic risk than the 60 industrials.

CONCLUDING OBSERVATIONS

Regulatory rate hearings reveal the three common approaches to estimating equity capital costs, the CE, CAPM, and DCF models, coexist more as rival rather than complementary techniques. It has been the purpose of this paper to reconcile these three approaches to public utility rate regulation.

Two of the three estimating procedures, ke and $E(R_j)$, were shown to conform with the notion of a just and reasonable return from both a legal and economic vantage point. A comparison of R_{cec} measures with ke and $E(R_j)$ revealed R_{cec} has serious shortcoming as a measure of equity capital cost. R_{cec} is not an opportunity cost construct but rather is an average (book) return on past (book) investments. Also, there is no theory about the relationship of risk and average book rates of return.

Despite these shortcomings, R_{cec} is used as a measure of equity capital costs by financial experts witnesses in rate hearings. A R_{cec} estimate is generally non-replicable because it is the mean return on book equity for a set of firms the expert judges to have corresponding risks. Accounting beta and market beta measures were used in this paper

to identify sets of industrial firms with comparable risks and, thereby, introduce replicability into the CE methodology. The seven sets of industrial firms were structured to have a size of 60 firms and median accounting/market betas equal to the corresponding beta measures for the 30 utility sample. Estimates of $E(R_j)$, ke, and R_{cec} were calculated for the seven industrial sets and the utility groups for 1976.

It was found that the R_{cec} and $E(R_j)$ measures were somewhat similar in magnitude for the sets of industrial firms. The ke measure for industrials displayed a much wider dispersion than utilities on both a within and between sets basis due to the impact of earnings variability on the growth component of ke. The equity capital cost measures for the utility sample were substantially lower than for the sets of industrial firms with comparable risks as measured by accounting and market betas. An explanation for this is that despite accounting beta comparability, the market measure of risk (β_{market}) revals the industrial sets have portfolio betas of approximately 1.1 while the utility portfolio beta is only .8. Specification of sets of corresponding risk firms might better be handled by first identifying industrial firms with market betas similar to utilities, and then selecting sets of firms with comparable accounting earnings characteristics.

It is hoped that this initial effort to reconcile the three common approaches to estimating equity cost in rate hearings will stimulate further research that will ultimately resolve the conflicts associated with rate of return hearings.

FOOTNOTES

[1]F.P.C. v. Hope Natural Gas Company, 320 U.S. 591 (1949) at 603.

[2]Once investors' expectations about investment opportunities offering returns greater than ke became capitalized in the share price, then expected project returns greater than ke must be realized by the firm if investors are, in fact, to achieve their required ke return on the current share price.

[3]According to the National Association of Regulatory and Utility Commissioners [21, p. 432], more than half of the state commissions rely upon or accept the CE method of determining the cost of equity capital.

[4]The HPR and R_{cec} measures for 1976 are geometric means of the five year period 1972-1976.

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